

NMR Study of the Binary ($H_2 + CH_4$) and ($H_2 + Xe$) Structure-I Clathrate Hydrate

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We represent the NMR study of H_2 migration in the binary ($H_2 + CH_4$) and ($H_2 + Xe$) structure-I (sI) clathrate hydrates. The synthesis of pure sII hydrogen clathrate hydrate requires the extremely high pressure condition, but with the aid of help gases that promote the lattice formation the binary H_2 sI clathrate hydrate can be readily made. The H_2 molecules captured into sI small cage (sI-S) at lower temperature migrate to sI large cage (sI-L) through shared pentagonal face of $5^{12}6^2$ cage. The hexagonal faces of $5^{12}6^2$ cage provide the windows essential for creating continuous diffusion paths for H_2 molecules. Thus far, although the vacant channels formed by linkage of specific cages have not received any attention in the inclusion phenomena of clathrate hydrates, it is essential to realize that these channels can play an important role in guest diffusion pathways and occupancy occurring in a complex clathrate hydrate matrix.